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AUGUST 1985 NUMBER 204

MONTHLY REPORT

ON THE NUCLEAR FUEL MARKET

NUEXCO

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MONTHLY REPORT ON THE NUCLEAR FUEL MARKET

August 1985 No. 204

R. WESLEY MILLER, *EDITOR* CLARK M. BEYER, *ASSOCIATE EDITOR*

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To Our Readers

Nuexco is pleased to announce that an agreement has been reached under which Oren L. Benton will purchase control of Nuexco. This agreement has the enthusiastic support of Nuexco's shareholders and employees, including George White, Jr., Jim Vaughan, Bob Wolcott, Wayne Fowler and others. Oren has assumed the chief executive officer position of Managing Director. All of the above named individuals will be actively associated with Nuexco in various capacities.

Oren, age 51, is a Certified Public Accountant and a resident of Denver, Colorado. He was associated for nearly twenty years, until 1975, with the international accounting firm of Arthur Andersen & Co., where, as a general partner, he was a financial and tax consultant to utilities, natural resource companies, banks, and insurance companies. In 1975, he resigned from Arthur Andersen and, until 1982, was a consultant to Bob Adams and Vice Chairman of Energy Fuels. Following Bob's death, Oren served as an executor of the Adams' estate and, in early 1983, concurrent with the sale of Energy Fuels to John Adams, terminated his business relationship with that organization.

While continuing to serve as an estate executor, Oren also pursued other personal business and investment interests, and joined Nuexco's Board of Directors in August 1983. Oren's background as an independent consultant, together with his extensive involvement and experience in the international nuclear fuel industry, will accelerate the development and expansion of Nuexco's services to the industry.

* * *

Nuexco will host a hospitality suite during the Uranium Institute's Tenth Annual Symposium in London, England. The suite will be located at the Savoy Hotel, September 3-5. We look forward to seeing you there.

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NATURAL URANIUM AND SECONDARY MARKET CONVERSION

The **Exchange Value** as of July 31, 1985 is **$15.75** per pound U_3O_8, up $0.75 since last month. **Active supply** of natural uranium (U_3O_8 and UF_6) for spot or near-term delivery totals **3,035,000** pounds equivalent U_3O_8 as concentrates or UF_6, down 485,000 pounds since last month. The corresponding figure for **active demand** is **455,000** pounds, down 870,000 pounds. The spot and near-term **supply-demand ratio** rose to **6.7:1.**

The *Current Market Data* section of this Report lists eight natural uranium sales transactions, involving a total of approximately 1,800,000 pounds U_3O_8 equivalent. Seven of the transactions reported this month involved deliveries in the near term, and four met the criteria for inclusion in the current Transaction Value calculation.

The **UF_6 Value** as of July 31, 1985 is **$44.00** per kilogram U in UF_6, up $1.50 since last month. Five of the transactions reported this month involved UF_6.

The **Transaction Value** as of July 31, 1985 is **$14.75** per pound U_3O_8, up $0.15 since last month. The current Transaction Value includes 17 transactions involving a total of 4.8 million pounds U_3O_8 or equivalent UF_6 and covers a period of 3 months.

The **Loan Use Charge Rate** as of July 31, 1985 is unchanged at **5 percent** per annum, as lenders continued to offer substantial quantities of material at that rate.

* * *

The Exchange Value rose to $15.75 as higher prices became evident in transactions and bids following the rise in sellers' offers that began last month. As is customary in moving markets, the gap between sellers' offers and buyers' bids has widened. When any firm demand materializes, sellers compete aggressively for the available business, sustaining the buyers' market that has prevailed for the past several years. In July, the strong response to one utility's demand for a large quantity of material continued the pattern.

Buyers shared the growing sense of market firming and, although most of the transactions reported this month involved UF_6, indicated that they were willing to pay above $15.50 per pound U_3O_8 equivalent. An important factor in that willingness was the decline of the US dollar relative to most currencies. Even after taking into account the five-percent rise in the Exchange Value (as expressed in US dollars), the value of uranium as expressed in most other currencies actually declined. For example, the table on page 4 of this Report shows that last month's Exchange Value was equivalent to 139.41 French francs, but declined three percent this month, to 135.43. Similar differentials applied to Belgium, the Federal Republic of Germany, Spain, Sweden, Switzerland, the United Kingdom, and others. Thus, most sellers outside the USA would need higher US dollar prices to avoid losing ground. On the other hand, most non-US buyers would be able to pay higher US dollar prices without losing anything in terms of their own currencies.

Traders again played an active role in this month's transactions. One US utility sold most of its inventory to traders, and shortly thereafter the material reappeared in the market at higher offering prices. Another effect of traders' activity was an apparent inflation of supply. Believing that several lots of material being offered (ostensibly on an exclusive basis) were actually being offered by multiple parties, one buyer remarked that he only expected to get two-thirds of the total quantity he had just agreed to purchase.

At present, many sellers are holding material (or offering it at prices well above the current Exchange Value) in anticipation of higher prices in the near term. Several utilities have indicated their intent to buy material in the last few months of 1985. Current demand for natural uranium is thin and sporadic. Buyers demanding natural uranium often prefer UF_6, so active demand for concentrates was low throughout July. However, several sources of firm demand for substantial quantities of concentrates are expected to appear in early August.

* * *

The UF_6 Value also rose as a result of the higher transaction prices and active trading in UF_6. Canadian suppliers have been able to sell large quantities of UF_6 (or U_3O_8 that *must* be converted at Eldorado) at competitive prices, and will be the dominant competitors for upcoming business, as they remain active while other producers often seem intent upon holding out for higher prices at the end of the year.

* * *

The **Conversion Value** is **$1.60** per pound U in UF_6, unchanged since last month. The supply of secondary market conversion services diminished as possible suppliers continue to stand apart from the market. Demand is at a minimum and little activity is expected in the coming weeks. No secondary market conversion transactions are reported. Active supply of secondary market conversion services for delivery within three years totals 360 thousand pounds U as UF_6. Active secondary market demand for conversion amounts to 425,000 pounds U in UF_6.

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ENRICHED URANIUM AND SWUS

The Nuexco **SWU Values** as of July 31, 1985 are:

1. For **DOE origin,** a tails assay of 0.30 weight-percent U_{235}, for delivery by the end of FY86, and certifiable as excess, $85 per SWU, down $3.

3. For **other** SWUs (includes DOE origin SWUs not certifiable as excess and non-DOE origin SWUs), for delivery by the end of calendar year 1986, $81 per SWU, down $2.

Two secondary market SWU transactions are reported, involving less than 50 thousand SWUs.

* * *

The price distinctions between DOE-certifiable and non-certifiable or other origin SWUs are becoming less obvious as the markets converge. Prices continue to drop as opportunities appear one at a time and sellers cut their prices to complete the sale. The two SWU transactions reported this month involved small quantities of material, yet transaction prices illustrated the continuing downward drift of SWU prices. As in the past few months, buyers have been able to obtain lower prices with each succeeding sale, due to the seller competition and complete lack of any other demand. These conditions should apply for some time, and consequently little secondary SWU market activity can be expected.

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CURRENT MARKET DATA

July 31, 1985	Market Values	Active Supply[1] (thousands)	Active Demand[1] (thousands)
EXCHANGE VALUE	**$15.75**/lb. U_3O_8	3,035	455
UF_6 VALUE	**$44.00**/kgU		
CONVERSION VALUE	**$1.60**/lb. U as UF_6	360	425
SWU VALUES			
DOE origin, certifiable as excess, 0.3 tails assay delivery by the end of FY85	**$85**/SWU		
Other SWUs (non-DOE or non-certifiable) delivery by the end of calendar year 1986	**$81**/SWU		
LOAN USE CHARGE RATE	5%/annum	0	300

TRANSACTION VALUE	$/lb. U_3O_8	Millions of Pounds	Number of Transactions	Number of Months
	14.75	4.8	17	3

[1]Supply and demand tables in the *Current Market Data* section of this Report detail the numbers for each category.

DEFINITIONS

1. The **Exchange Value** is Nuexco's judgment of the price at which transactions for significant quantities of natural uranium concentrates could be concluded as of the date indicated.
2. The **UF_6 Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of natural uranium hexafluoride could be concluded as of the date indicated.
3. The **Conversion Value** is Nuexco's judgment of the price at which spot and near-term transactions for significant quantities of conversion services could be concluded in the secondary market as of the date indicated.
4. The **SWU Values** represent Nuexco's judgment of the price at which transactions for the sale of significant quantities of SWUs of stated origin for delivery in the specified time period could be concluded as of the date indicated.
5. The **Loan Use Charge Rate** is Nuexco's judgment of the annual interest rate at which uranium loans could be concluded as of the date indicated.
6. The **Transaction Value** is a weighted average price of recent natural uranium sales transactions. The calculation is based on prices paid in:
   a. Transactions closed within the previous three-month period for which delivery is scheduled within one year of the transaction date;
   b. At least ten transactions;
   c. Transactions involving a sum total of at least 2 million pounds U_3O_8 equivalent.

   The sample time is extended as necessary to include these minima. Other currencies are converted to US dollars using conversion rates in effect on or near the transaction date.

DERIVATIONS AND COMMENTS

1. All Market Values are based on:
   a. Data from recently completed transactions.
   b. Data from pending transactions.
   c. Firm bids to buy or borrow, and firm offers to sell or lend.
   d. Prices purchasers or rates borrowers have expressed a willingness to pay, but for which Nuexco is not aware of firm bids to buy or borrow, and prices sellers or rates lenders have expressed a willingness to offer, but for which Nuexco is not aware of firm offers to sell or lend.
2. Prices associated with deliveries under old or renegotiated contracts or other than arm's-length transactions are not considered in the determination of these Market Values.
3. In the determination of the Conversion Value, Nuexco does not consider transportation charges other than those customarily provided by primary suppliers of conversion services.
4. The prices of conversion services or SWUs delivered under long-term contracts with primary suppliers are not considered in the determination of either the Conversion Value or SWU Value.
5. For the DOE SWU Values, Nuexco converts SWU prices at varying tails and product assays to equivalent SWU prices at a tails assay of 0.30 weight-percent U_{235} and a product assay of 3.0 weight-percent U_{235}, assuming feed costs corresponding to the Nuexco Exchange and Conversion Values determined as of the same date.
6. In calculating the Transaction Value, Nuexco does not account for the price of uranium delivered in connection with contracts which call for "market price" mechanisms. This exclusion applies particularly to contracts in which delivery prices are expressed as a function of future Exchange Values or any other indeterminant variable. Also excluded from the calculation are any other transactions in which the delivery price is defined in such a way that it cannot currently be determined.

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CURRENT MARKET DATA

EXCHANGE VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
	This Month (July 31, 1985)	Last Month (June 30, 1985)	12 Months Ago (July 31, 1984)	This Month (July 31, 1985)	Last Month (June 30, 1985)	12 Months Ago (July 31, 1984)
Australia (dollar)	21.82	22.50	21.08	56.74	58.49	54.81
Belgium (comm. franc)	893.87	921.24	1,023	2,324	2,396	2,661
Canada (dollar)	21.29	20.45	23.01	55.35	53.16	59.82
Finland (markka)	93.14	95.12	106.58	242.14	247.28	277.08
France (franc)	135.43	139.41	155.42	352.08	362.42	404.05
FRG (mark)	44.50	45.76	50.64	115.70	118.96	131.64
Italy (lira)	29,689	29,222	31,117	77,185	75,972	80,896
Japan (yen)	3,739	3,732	4,304	9,721	9,703	11,189
Netherlands (guilder)	49.81	51.69	57.23	129.50	134.38	148.78
South Africa (rand)	32.21	29.50	28.62	83.74	76.69	74.40
Spain (peseta)	2,579	2,619	2,861	6,705	6,810	7,439
Sweden (krona)	130.38	132.04	146.81	338.96	343.28	381.68
Switzerland (franc)	36.33	38.34	43.08	94.46	99.68	112.00
UK (pound)	11.11	11.58	13.37	28.89	30.11	34.77
US (dollar)	15.75	15.00	17.50	40.95	39.00	45.50

TRANSACTION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U_3O_8 in Concentrates			per kg. U in Concentrates		
	This Month (July 31, 1985)	Last Month (June 30, 1985)	12 Months Ago (July 31, 1984)	This Month (July 31, 1985)	Last Month (June 30, 1985)	12 Months Ago (July 31, 1984)
Australia (dollar)	20.44	21.90	20.00	53.13	56.93	52.00
Belgium (comm. franc)	837.12	897.36	970.76	2,176	2,332	2,524
Canada (dollar)	19.94	19.90	21.82	51.83	51.74	56.74
Finland (markka)	87.23	92.58	101.10	226.77	240.69	262.83
France (franc)	126.83	135.69	147.42	329.72	352.76	383.27
FRG (mark)	41.68	44.54	48.03	108.35	115.79	124.87
Italy (lira)	27,804	28,443	29,516	72,284	73,946	76,736
Japan (yen)	3,502	3,632	4,083	9,104	9,444	10,614
Netherlands (guilder)	46.65	50.31	54.28	121.27	130.80	141.13
South Africa (rand)	30.16	28.71	27.15	78.42	74.64	70.57
Spain (peseta)	2,415	2,549	2,714	6,279	6,628	7,056
Sweden (krona)	122.10	128.52	139.26	317.44	334.13	362.05
Switzerland (franc)	34.03	37.32	40.87	88.46	97.03	106.24
UK (pound)	10.41	11.27	12.69	27.05	29.31	32.98
US (dollar)	14.75	14.60	16.60	38.35	37.96	43.16

[1]Calculated using currency exchange rates published in the *Wall Street Journal* on July 31, 1985.

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CURRENT MARKET DATA

CONVERSION VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	per lb. U as UF_6			per kg. U as UF_6		
	This Month (July 31, 1985)	Last Month (June 30, 1985)	12 Months Ago (July 31, 1984)	This Month (July 31, 1985)	Last Month (July 31, 1985)	12 Months Ago (July 31, 1984)
Australia (dollar)	2.22	2.40	0.00	4.89	5.29	0.00
Belgium (comm. franc)	90.81	98.34	0.00	200.19	216.80	0.00
Canada (dollar)	2.16	2.18	0.00	4.77	4.81	0.00
Finland (markka)	9.46	10.15	0.00	20.86	22.37	0.00
France (franc)	13.76	14.87	0.00	30.33	32.78	0.00
FRG (mark)	4.52	4.88	0.00	9.97	10.76	0.00
Italy (lira)	3,016	3,117	0.00	6,649	6,871	0.00
Japan (yen)	379.87	398.11	0.00	837.46	877.68	0.00
Netherlands (guilder)	5.06	5.51	0.00	11.16	12.16	0.00
South Africa (rand)	3.27	3.15	0.00	7.21	6.94	0.00
Spain (peseta)	261.99	279.43	0.00	577.60	616.03	0.00
Sweden (krona)	13.25	14.08	0.00	29.20	31.05	0.00
Switzerland (franc)	3.69	4.09	0.00	8.14	9.02	0.00
UK (pound)	1.13	1.24	0.00	2.49	2.72	0.00
US (dollar)	1.60	1.60	0.00	3.53	3.53	0.00

SWU VALUES AND UF_6 VALUE EXPRESSED IN SELECTED PRODUCER & CONSUMER CURRENCIES[1]

Country (currency)	DOE SWU Delivery by the End of FY86 (July 31, 1985)	Non-DOE SWU Delivery by the End of CY86 (July 31, 1985)	UF_6 Value per kg. U in UF_6 This Month (July 31, 1985)	UF_6 Value per kg. U in UF_6 Last Month (June 30, 1985)
Australia (dollar)	117.78	112.24	60.97	63.75
Belgium (comm. franc)	4,824	4,597	2,497	2,612
Canada (dollar)	114.90	109.49	59.48	57.93
Finland (markka)	502.66	479.01	260.20	269.50
France (franc)	730.87	696.47	378.33	394.98
FRG (mark)	240.18	228.88	124.33	129.65
Italy (lira)	160,226	152,686	82,941	82,797
Japan (yen)	20,180	19,231	10,446	10,574
Netherlands (guilder)	268.82	256.17	139.15	146.45
South Africa (rand)	173.82	165.64	89.98	83.58
Spain (peseta)	13,918	13,263	7,205	7,422
Sweden (krona)	703.64	670.53	364.24	374.12
Switzerland (franc)	196.08	186.85	101.50	108.64
UK (pound)	59.96	57.14	31.04	32.82
US (dollar)	85.00	81.00	44.00	42.50

[1]Calculated using currency exchange rates published in the *Wall Street Journal* on July 31, 1985.

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CURRENT MARKET DATA

RECENT TRANSACTIONS[1]

Uranium Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity (thousands of pounds, U_3O_8 equivalent)	Approximate Price as Percent of Current Exchange or UF_6 Value	Seller	Buyer	Remarks
3506	1985-1986	301-600	see remarks	Canadian Producer	European Utility	UF_6. Market-related price, with ceiling.
3504	1986	101-300	100	Trader	US Utility	UF_6.
3503	1985	101-300	99	Trader	US Utility	UF_6.
3500	1986-1990	101-300	94-143	US Producer	US Producer	Series of fixed prices.
3498	1986	301-600	98	Canadian Producer	European Utility	
3497	1985	301-600	see remarks	Canadian Producer	European Utility	Market-related price, subject to ceiling and other provisions.
3494	1985	101-300	R[5]	Trader	US Utility	UF_6.
3493	1985	101-300	97	US Utility	Trader	UF_6

Enrichment Services
Secondary Market Sales

Nuexco Transaction Number	Delivery Period	Approximate Quantity[2] (thousands of SWUs)	Approximate Price[3] as Percent of Current SWU Value[4]	Seller Group	Buyer Group	SWU Origin	Remarks
3507	1986	less than 50	100	R[5]	US Utility	DOE	
3489	1985	less than 50	111	European Entity	US Utility	DOE	

[1]Transactions listed are not limited to those in which Nuexco was involved, but also include others of which Nuexco is aware.
[2]If tails assay is unknown or unspecified, Nuexco's calculation of SWU quantity assumes 0.30 w/o tails assay.
[3]Price is not normalized to 0.30% tails assay.
[4]Refers to SWU Value that corresponds to SWUs included in transaction. When prices and SWU values are expressed as discounts (e.g., X dollars less than DOE's USEC base price at time of delivery), the percentage refers to the ratio of the *discounts*, not the ratio of the prices.
[5]The notation *R* means that Nuexco either does not know, or that Nuexco has restricted that information to protect client confidentiality.

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URANIUM SUPPLY
(July 31, 1985)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
1860*	250	1,000 per year	UF_6
2134*	50	220 per year	1986-87
2335	275	—	
2389	300	—	
2483	545	—	
2654	500	500 per year	UF_6
2705A	200	—	UF_6
2711*	35	—	
2728*	200	500 per year	UF_6; 1986-90
2746*	180	—	UF_6
2814	500	500	UF_6
2625	—	250 per year	1987-89
2680	—	250 per year	1986-92
TOTAL:	3,035		
INACTIVE			
2191	125	—	UF_6
2336	250	250 per year	1985-94
2553	300	—	
2297	—	200 per year	1986-89
TOTAL:	675		

*New or revised since last month.
[1]Measured from the date of this Report.
[2]For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.
Projects removed since last month: 2670, 2673.

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CURRENT MARKET DATA

URANIUM DEMAND
(July 31, 1985)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Inquiries to Purchase:			
ACTIVE			
2590	75	—	U_3O_8 or UF_6
2681*	250	500	UF_6
2757*	130	—	UF_6
2217	—	1,000 per year	1989-95
2507	—	600	1987-89
2741*	—	600	
2758*	—	500	UF_6
TOTAL:	455		
INACTIVE			
2548	290	—	
2576	20	—	UF_6
2636	100	—	
2676*	1,000	—	
2718*	250	350	
2414*	—	175	
2586	—	300	1987
2643	—	150 per year	1987 on
2694	—	625	1987; UF_6
TOTAL:	1,660		

*New or revised since last month.
[1]Measured from the date of this Report.
[2]For delivery within one year. This category excludes material deliverable within one year under other than spot or near-term contracts.
Projects removed since last month: 2457, 2695, 2750.

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LOAN SUPPLY AND DEMAND
(July 31, 1985)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U_3O_8) Within 1 Year	Beyond 1 Year	Remarks
Available for Loan: INACTIVE			
1938	2,000	—	UF_6
2036	500	—	
2469A	800	—	
2483	550	—	
2667	800	—	
TOTAL:	4,650	—	
Inquiries to Borrow: ACTIVE			
2606	300	—	
TOTAL:	300		

*New or revised since last month.
[1]Measured from the date of this Report.
Projects removed since last month: None.

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CURRENT MARKET DATA

CONVERSION SUPPLY AND DEMAND
(July 31, 1985)

Nuexco Project Number	Delivery Period[1] (Thousands of Pounds U as UF6) Within 3 Years	Beyond 3 Years	Remarks
Available for Sale:			
ACTIVE			
2511	—	300	1986-90
2725	360	—	
TOTAL:	360		
Inquiries to Purchase:			
ACTIVE			
2587	35	—	
2596	—	600	
2617	275	420	1986-91
2709*	115	—	
TOTAL:	425		
INACTIVE			
2529	225	—	
2724	—	375	1989-93
TOTAL:	225		

*New or revised since last month.
[1]Measured from the date of this Report.
Projects removed since last month: 2419, 2438, 2677.

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SWU SUPPLY
(July 31, 1985)

Nuexco Project Number	Delivery Period[1] (Thousands of SWUs) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Available for Sale:			
ACTIVE			
2607	200	—	
2624	100	—	
2705	40	—	
2410A	—	350	
2571	—	55	1987
2684	—	35	
TOTAL:	340		
INACTIVE			
2359	—	200	
2378	—	120	1988
2652	—	25	1986
TOTAL:	0		

*New or revised since last month.
[1]Measured from the date of this Report.
[2]For delivery within one year. This category excludes SWUs deliverable within one year under other than spot or near-term contracts.
Projects removed since last month: None.

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CURRENT MARKET DATA

SWU DEMAND
(July 31, 1985)

Nuexco Project Number	Delivery Period[1] (Thousands of SWUs) Spot or Near-term[2]	Intermediate or Long-term	Remarks
Inquiries to Purchase:			
ACTIVE			
2400	—	150	1987-90
2519	—	30 per year	1987 on
2578	115	—	
2668*	—	15	
2747*	30	50	1987 on
TOTAL:	145		
INACTIVE			
2500	—	170	1988
2512	—	15 per year	1987 on
2595	—	50	1986
2693	—	100 per year	1989-90
2706	—	30	
TOTAL:	0		

*New or revised since last month.
[1]Measured from the date of this Report.
[2]For delivery within one year. This category excludes SWUs deliverable within one year under other than spot or near-term contracts.
Projects removed since last month: 2543, 2597.

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OPTIMUM TAILS ASSAY—Part 4

(Note: The first three parts of this series on the Optimum Tails Assay were published in succession in Reports 195, 196, and 197, November 1984 through January 1985.)

Introduction

Part 1 of this series demonstrated that the *traditional* concept of the optimum tails assay (the tails assay for which the unit cost of enriched uranium product is a minimum) requires the assumption that the unit costs of feed material and SWU are both known constants. Part 2 discussed the variability of SWU prices with tails assays for a constant product cost, and extended the concept of minimum product cost to some instances of varying SWU price. Part 3 expanded the analysis to include the dependence of inventory carrying costs on the tails assay, and discussed a better definition of an optimum tails assay for nuclear fuel management. This fourth article addresses the DOE incentive SWU pricing plan's impact on the optimum tails assay for FY87-FY90 deliveries.

The Incentive Pricing SWU Option

Most of DOE's enrichment customers that converted to the USEC have accepted the incentive price option, which allows them to purchase additional SWU at a reduced price when those SWU are in excess of 70 percent of their requirements. The majority of these customers will be able to take 70 percent of their requirements under the original terms of the USEC and 30 percent under the incentive pricing rules.

The incentive pricing option applies to FY87 through FY90 deliveries; the incentive price will be $90 per SWU (fixed in 1987 and 1988 and escalated for 1989 and 1990). The price is based on DOE's variable cost of production. The price under the Utility Services enrichment contract (USEC) has been $135 in FY84 and FY85. For future years, DOE will apply a price ceiling of $135 escalated from 1984, and a FY86 price of approximately $125 is under consideration by DOE. In addition to lowering the base price, the incentive pricing option calls for a VTAO surcharge of zero. That is, customers accepting the incentive pricing plan will be allowed to vary the tails assay on the affected 30 percent of requirements at no additional charge.

DOE has established a policy dictating that the same tails assay must be used for both regular USEC and Incentive Price SWU. Thus, the cost of enriched product under the USEC with incentive pricing is given by the following equation:

$$\text{Product Cost} = \text{Feed Factor} \times \text{Feed Unit Cost} + \text{SWU Factor} \times [A \times \text{Incentive Price} + (1 - A) \times (\text{USEC Base Price} \times (0.86 + 0.7 \times \text{Tails Assay}))],$$

where A is the fraction of requirements delivered under the incentive pricing plan and the tails assay ranges from 0.20 to 0.30 w/o U_{235}.

Table 1 gives the optimum tails assay for FY87 as a function of uranium costs and SWU prices.

For any given feed cost, higher SWU prices tend to yield higher values for the optimum tails assay. However, the SWU price differentials in this case (Table 1) have relatively little impact on optimum tails assays. Thus, the optimum tails assay under the USEC (for any given feed cost) falls within an interval width of 0.02 w/o, whether the basic SWU price is $90, $125 or $135. Moreover, for most feed costs below $50 per pound U_3O_8, the interval width is only 0.01 w/o. Thus, the optimum tails assay is not sensitive to the customer's election of the incentive pricing option *under the USEC*.

Table 1

OPTIMUM TAILS ASSAY WITH INCENTIVE PRICING OFFER

	Optimum Tails Assay (in units of w/o)		
	Incentive Price	USEC Price with VTAO Surcharge	
U_3O_8 Cost ($/Lb.)[1]	$90/SWU	$125/SWU	$135/SWU
15	0.30	0.30	0.31
20	0.27	0.27	0.28
25	0.25	0.25	0.26
30	0.23	0.23	0.24
35	0.21	0.21	0.23
40	0.20	0.21	0.21
45	0.19	0.20	0.20
50	0.18	0.20	0.20

[1] Assumes $1.50 per pound U as UF_6 conversion cost.

Relationship to VTAO Surcharge

In reviewing the intent of the VTAO surcharge, it can be seen that this effect is definitely not a coincidence.

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Higher tails assays reduce the number of required SWUs, and DOE introduced the VTAO surcharge to cover the fixed costs associated with SWUs not delivered when higher tails assays were selected. In introducing the VTAO surcharge, DOE in essence reasoned that its customers should not be optimizing their tails assay based on the total cost of a SWU; approximately 30 percent of the total SWU costs are fixed, and should not be included in the optimization. The true product cost optimization equation should be:

Product Cost = Feed Factor × Feed Unit Cost
+ SWU Factor × Variable SWU Cost
+ Fixed SWU Cost.

When first analyzing the effect of the VTAO surcharge in Report 185 (January 1984), Nuexco observed that the optimum tails assay with the VTAO surcharge could be closely approximated by the optimum tails assay for the *variable cost of SUW without a surcharge.*

As long as the relationship between the incentive price, the USEC base price, and the VTAO surcharge is based on this cost/price philosophy, the parity between the optimum tails assays should still exist. In addition, this philosophy explains why there is no VTAO surcharge on the incentive price; the incentive price is based on variable costs, does not depend on the number of SWUs produced, and is therefore not a function of the tails assay.

Uranium Requirements

The incentive pricing plan should not measurably affect uranium consumption because it does not change the optimum tails assay from the one applicable to the USEC. However, if the real price of enrichment declines as a result of increased competition and improved technology, the optimum tails assay also will drop, and utilities will use less natural uranium and more SWU to obtain the required amounts of enriched product. However, uranium feed prices also influence the selection of optimum tails assays. As shown in Report 197 (January 1985), utilities should base their optimum tails assays on the expected cost of the next feed purchase, discounted if necessary for the future value of money. For a utility with no inventory, the spot market price would be a useful approximation. For a utility with five years of supply in inventory, the approximate feed value to use in optimizing fuel costs should be the expected 1990 U_3O_8 price, discounted by five years at the utility's cost of money. For example, if the utility could enter into a new contract today for delivery in 1990 at $20 per pound U_3O_8 plus escalation (assuming escalation at 6 percent per annum and a discount rate of 12 percent per annum based on cost of money or on opportunity cost), the appropriate feed value would be:

$$\$20 \times (1.06/1.12)^5 = \$15.20 \text{ per pound } U_3O_8.$$

One of the few positive notes for producers, especially those in the USA, is that some utilities currently are taking deliveries of SWU at tails assays lower than their optimum. As the options available to them become more sophisticated, their U_3O_8 consumption per kilowatt hour could increase in the near term.

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AUSTRALIA

Energy Resources of Australia's (ERA) Ranger mine produced approximately 6,694,000 pounds U_3O_8 in the fiscal year ending June 30, 1985. This figure coincides with current sales, and is one percent above the mill's rated capacity of 3,000 metric tons (mt) U_3O_8 per year (6,614,000 pounds). Tests have shown that the plant is capable of producing at a rate of over 4,000 mt per year. Since Ranger began operation in October 1981, it has produced over 25 million pounds U_3O_8.

NAMIBIA

Namibia's so-called transitional government, installed by South Africa in June, acquired an important stake in the Rossing uranium mine recently, when the Industrial Development Corporation of South Africa (IDC) transferred part of its 13.5-percent ownership interest to the new government. Although the transferred shares embody only 3.5 percent of the equity in Rossing Uranium Limited (RUL), they convey much more power. According to controlling stockholder Rio Tinto Zinc Corporation (RTZ), those shares account for a majority of the voting rights in Rossing by virtue of their being weighted more heavily than others. The transfer also gives the new government the right to nominate one of the nineteen members of the Rossing board; therefore, for the first time a Namibian government will have full access to information on the mine's operations.

The move is the first major change in the capital structure of Rossing Uranium Ltd. (RUL) since RTZ established it in 1974 as the operating company for the mine. However, as long as the government of Namibia is controlled from Pretoria, the change is more cosmetic than fundamental. A 1967 United Nations General Assembly mandate established the U.N. Council for Namibia as the *de jure* governmental authority for Namibia, but South Africa has retained control. Having been imposed over the objections of the council, the transitional government has so far failed to gain international recognition. In fact, the U.N. Security Council denounced the transitional government two days after its formal installation.

Rather than signifying any change in South Africa's policy on Namibia, IDC's transfer of Rossing equity to the transitional government is more properly regarded as a continuation of established policy. In that light, two likely objectives suggest themselves.

1. By giving it some economic influence, Pretoria probably hopes to enhance the likelihood of the transitional government's gaining acceptance by the people of Namibia. In that event, international recognition of the *de facto* government might become feasible.

2. The transfer could also serve to reduce the likelihood of legal action against RTZ and other companies for alleged exploitation of Namibia's natural resources under the Namibian Natural Resources Protection Act passed by the council in 1974. The act prohibits mining, processing or selling of Namibian resources without the council's consent. At present, the Council for Namibia is proceeding with legal action against Urenco, which enriches uranium for various European utilities that purchase Rossing uranium. The Dutch government's recognition of the act's validity prompted the council to seek the support of the Dutch government in a lawsuit against Urenco.

In the final analysis, South Africa's influence in the Rossing project is not likely to diminish noticeably given the new government's ties to South Africa. Furthermore, RTZ will retain its controlling interest and position as operator, so it is virtually certain that Rossing will be administered in a manner consistent with its recent past. (Table 2 indicates the revised equity distribution in RUL.) Nuexco projections indicate Rossing will produce approximately eight million pounds U_3O_8 in 1985. However, output could decline even further from the 1980 peak of 10.5 million pounds unless buyers are found to replace those whose contracts are running out in the near future.

Table 2

REVISED OWNERSHIP OF ROSSING URANIUM LTD.

Company	Country	Percent Share
Rio Tinto Zinc Corp.[1]	UK	41.35
Industrial Development Corp.	South Africa	10.0
Total Compagnie Miniere	France	10.0
Rio Algom Ltd.[1]	Canada	10.0
Urangesellschaft mbH	FRG	5.0
General Mining Corp.	South Africa	6.5
Windhoek government	Namibia	3.5
Undisclosed		13.65

[1]RTZ owns 51.3 percent of Rio Algom, so RTZ's net beneficial interest in Rossing is 46.5 percent.

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RECENT DEVELOPMENTS

SOUTH AFRICA

Second-quarter production from Chamber of Mines' producers amounted to 2,816,000 pounds U_3O_8, a 10.5-percent decline from the previous quarter (Table 3). The decline can be attributed to a 31-percent drop in production at Vaal Reefs, where throughput fell 22 percent and the yield declined 13 percent. Slight declines also occurred at Buffelsfontein and Harmony, while significant increases were reported at JMS (Free State Joint Metallurgical Scheme) and Randfontein.

Randfontein completed refurbishing work on its uranium plant during the second quarter, and as a result the plant in June achieved its rated production capacity of 300,000 metric tons of ore per month. Production at Western Deep Levels ceased during the second quarter; however, income continues due to sales of the company's stockpile of uranium.

* * *

Notwithstanding the recent escalation of political and social unrest in South Africa, no disruption in uranium supply is likely, for two reasons.

1. Most of the producers currently are holding large stockpiles of uranium. Nuexco estimates the nation's total in the range of 20,000,000 to 30,000,000 pounds U_3O_8, an amount sufficient to weather a complete cessation of production for a year or two.

2. Rioting has been confined to residential areas, and no protest has yet been directed against the mining industry.

The most immediate threat to mining in South Africa comes from the strike of black mineworkers scheduled for August 25. The National Union of Mineworkers, South Africa's largest black trade union, claims the strike would be honored by at least half of the nation's 550,000 black mineworkers and that it would affect 29 mines accounting for 70 percent of South Africa's gold production. The Chamber of Mines disputes those claims on several grounds.

1. In a recent vote regarding strike action, only 14 percent of the workers favored a strike. Subsequently, the union called for a conference of mineworkers to decide what action is necessary. The strike was approved by a special congress of 450 union delegates, not by a vote of the members.

2. The union is counting on support from nonmembers that may not materialize.

3. The union lacks the resources to support its members while on strike.

The strike can still be averted by negotiations. Multiple political and economic issues are at stake, as reflected in union demands for higher wages, shorter workweeks, etc. The union also wants an end to laws that prevent blacks from holding blasting certificates, a prerequisite to earning the formal designation of miner which would allow their advancement to higher pay levels.

The likely result of the current dispute is some form of economic concessions by management. However, if a strike does take place, it is likely to be short in duration. In any event, uranium supply will almost certainly not be disrupted.

Table 3
REPUBLIC OF SOUTH AFRICA:
1985 URANIUM PRODUCTION[1]
(Thousands of pounds U_3O_8)

Operation	First Quarter 1985	Second Quarter 1985	Year to Date
Beisa (St. Helena)	0	0	0
Blyvooruitzicht	0	0	0
Buffelsfontein	401	378	779
Chemwes (Stilfontein)	148	148	296
Dreifontein Consolidated	45	47	92
ERGO[2]	83	76	159
Harmony	256	225	481
Hartebeestfontein	239	222	461
JMS[3]	314	356	670
Randfontein	291	319	610
Vaal Reefs	1,156	799	1,955
Western Areas	150	189	339
Western Deep Levels	62	57	119
TOTAL	3,145	2,816	5,961

[1]Excludes Palabora Mining Company, which is not a member of the Chamber of Mines.
[2]ERGO = East Rand Gold and Uranium Co. Ltd.
[3]JMS = Free State Joint Metallurgical Scheme.

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URANIUM PRODUCTION IN THE USA

Introduction

The USA, which once accounted for most of the uranium produced in the commercial market, will produce only about ten percent of the world's uranium in 1985. While the end of the decline may be in sight, there are still more producer failures to come. Producers continue to curtail activities, relegate projects to standby status, or cease operations. It is doubtful that many once-successful producers will ever be able to resume production. Even a substantial increase in market demand would probably not be sufficient to restore the industry to its former prominence, because of the strong market positions held by producers in other countries. Producers in Canada, and to a lesser extent, South Africa and Australia, have superior competitive positions—large deposits, much higher ore grades, and lower costs. Furthermore, the world's utilities hold more than five years' worth of inventories, so any substantial improvement in conditions is four to six years away. Former producers have only two real hopes, both of which are unlikely:

1. Discovery of large, high-grade orebodies that are cost-competitive with Key Lake, Cigar Lake, and others.
2. Government assistance, perhaps in the form of a limitation on the import of uranium.

Outlook for the 1990s

A new group of smaller, opportunistic companies could end up as the future uranium producers in the USA. Using new exploration and recovery techniques, different financial and marketing arrangements, and discretionary control of higher-grade ore within deposits, these new producers may be able to make average deposits profitable. Avoiding low-grade ore has become extremely difficult. Since 1979, the average grade of ore processed in the USA has been 0.115 percent U_3O_8. This indicates the poor quality of remaining US resources and exemplifies the problem forced on the producer industry. To be competitive in the future, the grade of new ore deposits must be considerably higher, perhaps in the range of 0.40 percent to 0.60 percent. The companies' success ultimately depends upon their ability to produce uranium on a competitive basis in the world marketplace.

Figure 1 illustrates the relationship since 1954 between uranium reserves, exploration drilling, and market value as measured by the Nuexco Exchange Value. Table 4 lists historical US uranium reserves by cost category, along with annual U_3O_8 sales (annual net change in commercial commitments of domestic-origin uranium to domestic buyers).

Table 4

ERDA/DOE ESTIMATES OF US RESERVES AND U_3O_8 SALES[1]

	Reserves by Cost Categories[2]						U_3O_8 Sales[3]		Nuexco E.V. (year end average) (US $ per lb. U_3O_8)
Year	$8	$10	$15	$30	$50	$100	Annual	Cumulative	
	(thousands of short tons U_3O_8)								
1966-1973	273						—	55.6	6.30
1974	277						11.9	67.5	15.00
1975	200	315	420	600			12.5	80.0	35.00
1976		270	430	640			13.8	93.8	41.00
1977		250	410	680			13.9	107.7	43.20
1978			370	690			15.8	123.5	43.25
1979			290	690	920		16.5	140.0	40.75
1980			225	645	936	1,122	17.5	157.5	27.00
1981			112	470	787	1,034	16.3	173.8	23.50
1982				205	594	894	14.0	187.8	20.25
1983				180	576	889	13.0	200.8	22.00
1984-2000				NA	NA	NA	121.2	322.0	15.25

[1]Information adapted from ERDA/DOE 1974-1983 publications (Statistical Data of the Uranium Industry). See chapters on uranium resources, commercial U_3O_8 sales, and requirements.

[2]Uses "forward costs," comprising operating and capital costs, in present dollars, that will be incurred in production of the uranium. These include costs of labor, materials, electricity, royalties, payroll and production taxes, insurance, and applicable general and administrative costs. All previous expenditures (before the time of the estimate) for such items as property acquisition, exploration, mine development, mill construction, etc., are excluded. Also excluded are income taxes, profit, and the cost of money.

[3]Statistical Data of the Uranium Industry (USAEC), GJO-100 (83), page 65.

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RAW MATERIALS

Figure 1. Relationship between uranium reserves, exploration drilling, and market value as measured by the Nuexco Exchange Value.

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Recent History—1981 to Present

The US producer industry has deteriorated markedly since early 1981. Mines and mills have been closed, properties with proven ore reserves have been abandoned, and exploration and production are at their lowest levels in about 30 years. (Although one new mill began operation in February 1985, two recently completed mills have not begun operation.) Many companies have terminated all uranium activities. The collapse in recent years can be attributed largely to two conditions of the market:

1. Intense competition for diminishing amounts of unfilled U_3O_8 requirements from foreign producers exploiting high-grade, low-cost deposits;

2. The low price of U_3O_8 (as measured by the Nuexco Exchange Value), which has fluctuated below $18.00 per pound since February 1984 and has fallen as low as $14.25 per pound, well below production costs for most US producers.

Some encouragement may be drawn from recent exploration successes in Nebraska, Virginia, and Arizona. In each case, significant ore deposits have been delineated, and commercial development may be feasible. In fact, the future of the US industry may depend upon the success of these types of new discoveries. The following significant events which have occurred in rapid succession within the past four years summarize some of the conditions which led to the depressed state of the industry in the USA.

1981

The gradual decline in activity throughout the uranium industry began to gain momentum in 1981. Exploration was highest in the South Texas district for the second consecutive year; the Grants, New Mexico district was one of the least active. The shift to Texas drew attention to the potential cost advantages of solution mining opportunities arising from the occurrence of shallow, low-grade deposits. New production capacity became available, but it was more than offset by mill closures. Some producers began to prepare for the difficult future predicted by analysts, but those whose high-priced contracts insulated them from the effects of declining market prices could afford to wait.

Discoveries: Crow Butte deposit, 25-30 million pounds U_3O_8, in Crawford, Nebraska; controlled by Wyoming Fuel Company (50 percent) and Ferret Exploration Company, Inc. (50 percent).

Project Start-ups:

1. Union Energy Mining Co., 3,000 ton-per-day (tpd) mill, Red Desert, Wyoming;

2. Ogle Petroleum Inc., solution mine, 400,000 lbs. per year, Bison Basin, Wyoming;

3. Tenneco, solution mine, 200,000 lbs. per year, Webb Co., Texas;

4. Freeport-McMoRan Inc., by-product of phosphoric acid, 420,000 lbs. per year, Donaldsonville, Louisiana.

Project Curtailments:

1. Conoco/Pioneer, 50 percent of mines and mill, Falls City, Texas;

2. Cotter, 33 percent of mines and mill, Colorado and Utah;

3. Exxon, 33 percent of mill, 50 percent of mine, Highland, Wyoming;

4. Petrotomics, 50 percent of mill, Shirley Basin, Wyoming;

5. Homestake, 33 percent of mill, Grants district, New Mexico;

6. Rio Algom, 50 percent of mill, La Sal, Utah. Combined average production loss = 40 percent, 5,900 tpd. Construction was completed on the Plateau Resources 750 tpd mill at Ticaboo, Utah, and the Bokum Resources 2,000 tpd mill at Marquez, New Mexico, but neither mill operated.

Project Closures:

1. Federal American Partners, all mines and mill, Gas Hills, Wyoming;

2. Union Carbide, Uravan, Colorado mill;

3. Western Nuclear, Irigaray solution mine, Powder River Basin, Wyoming;

4. Pioneer Nuclear, four mines, Uravan district, Colorado;

5. Sohio, mine and mill at Seboyeta, New Mexico;

6. Ranchers, Hope mine, Grants district, Colorado;

7. Phillips, Nose Rock mine, Crownpoint, New Mexico;

8. Homestake, one mine, Grants district, New Mexico.

Approximate production loss of 3,950 tpd.

Projects Deferred:

1. Conoco, one mine, Crownpoint, New Mexico, and JD7 mine, Uravan district, Colorado;

2. Cleveland Cliffs Iron, two mines and mill, Pumpkin Buttes, Wyoming;

3. Homestake, Pitch mill, Gunnison, Colorado;

4. Amoco Minerals, all projects;

5. Wyoming Mineral Corp., all projects.

1982

The reduction of exploration drilling to 6.1 million feet during the year, down from 14.1 million in 1981, illus-

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trates the further decline in activity. The announcement of an important discovery in Virginia was offset by the general decline in number of operating companies. The major oil companies exhibited this pattern, as eight out of fifteen elected to abandon projects; only about 23 companies were active at the beginning of the year. Most exploration activity occurred in Arizona and Nebraska. French American Metals Corporation (a subsidiary of the French conglomerate Cogema) acquired 80 percent of Pathfinder Mines, Inc., raising speculation that the overall situation might improve, but other takeovers were not imminent. The Nuexco Exchange Value fell from $23.00 to $17.00, returning to $20.25 by the end of the year. The slight price increase, though short-lived, provided some optimism for industry participants, but it did not fundamentally alter subsequent events. Production declined to 26.8 million pounds U_3O_8, a drop of 32 percent.

Discoveries:

1. Swanson deposit, over 30 million lbs., Pittsylvania Co., Virginia, controlled by Marline Uranium Corp.;
2. Dena Rich deposit, 5-7 million lbs., Grants district, New Mexico, controlled by Midas International, Inc.;
3. Crow Butte deposit reserve estimate revised upward to approximately 44 million lbs.

Project Start-up: Plateau Resources, 750 tpd mill, Ticaboo, Utah.

Project Curtailments:

1. Atlas Corp., 50 percent of mines and mill, Moab, Utah;
2. Western Nuclear, 40 percent of all mines and two mills, Wyoming and Washington;
3. Exxon, 30 percent of surface mine and mill, Highland, Wyoming;
4. Homestake, 20 percent of mill, Grants district, New Mexico;
5. Kerr-McGee, 40 percent of mines and mill, Grants district, and 20 percent of mines, Church Rock, New Mexico;
6. Union Carbide, 50 percent of mine, Gas Hills, Wyoming, and 50 percent of mines, Uravan district, Colorado.

Project Closures:

1. Gulf Minerals, Mariano Lake mine, Mt. Taylor mine, Grants district, New Mexico;
2. Kerr-McGee, Lee mine shaft, Grants district, New Mexico;
3. Sunedco, closed out all exploration;
4. Western Nuclear, Ruby #3 and #4 mines, Grants district, New Mexico, Sherwood mine and mill, Wellpinit, Washington;
5. Phillips Petroleum withdrew altogether from the mineral industry;
6. Conoco terminated all mineral activity;
7. Texaco phased out all uranium projects;
8. Sohio withdrew from all uranium projects, Seboyeta, New Mexico assigned to Sohio subsidiary, Kennecott Copper;
9. Dawn Mining Co., mill at Ford, Washington. Approximate production loss of 2,450 tpd.

Related Activities:

1. Atlas Corp. purchased Exxon's ore deposit, Shootaring Canyon, Utah;
2. Pioneer Nuclear received radioactive materials license for Slick Rock, Colorado project;
3. Sohio renewed radioactive materials license for mill, Seboyeta, New Mexico;
4. Anaconda received radioactive materials license, Rhode Ranch project, South Texas district;
5. TVA purchased 17,000 acres of land from Federal-American Partners, Gas Hills district, Wyoming;
6. Marline Uranium and Union Carbide formed joint venture to evaluate the Swanson ore body, Pittsylvania Co., Virginia.

1983

The uranium market stabilized briefly as the Nuexco Exchange Value rose to $24.00 by mid-year, falling to $22.50 in December. However, production dropped to 21.2 million pounds and exploration drilling experienced another 50-percent decline to 3.2 million feet. That figure was 97 percent below the high of 47 million feet drilled in 1978. The Arizona Strip north of Grand Canyon National Park was the most active exploration area for the second consecutive year. At least five major companies were involved in the area. Energy Fuels continued to have modest success in locating new reserves, and at present operates three mines and is developing another. In general, however, mine and mill production continued to decline.

Discoveries:

1. Canyon breccia pipe, Yavapai Co., Arizona, controlled by Energy Fuels,
2. A small, high-grade deposit at Carpenter Flat, Uravan district, Colorado, controlled by Mineral Recovery Corp.

Project Start-ups:

1. Everest Minerals, Mt. Lucas solution mine, 400,000 lbs. per year, South Texas district;

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2. Pathfinder Mines, underground mine off pit wall, 2R South pit, Gas Hills, Wyoming;
3. Energy Fuels, exploration shaft, Pigeon pipe, Arizona Strip, Arizona.

Project Curtailments:
1. Homestake dismissed 40 employees in Grants district, New Mexico;
2. Union Carbide dismissed 197 employees and shut down mines and mill at Uravan district, Colorado, and dismissed 104 employees at Gas Hills, Wyoming.

Project Closures:
Union Energy Mining Co., Sweetwater mine and mill, Red Desert, Wyoming;
2. Energy Fuels, all mines and mill, White Mesa project, Blanding, Utah;
3. Homestake, Pitch mine, Gunnison, Colorado;
4. Union Carbide, Uravan mill, Uravan district, Colorado.
Approximate mill production loss of 6,300 tpd.

Related Activities:
1. Everest Minerals purchased Exxon's mines and mill in Highland, Wyoming;
2. Mobil received approval for new processing plant in Crownpoint, New Mexico;
3. Wyoming Mineral purchased Conoco's 50-percent interest in the Crownpoint, New Mexico project;
4. Conoco sold its Ruby Ranch project in Powder River Basin, Wyoming, to Santa Fe Mining;
5. Energy Fuels received authorization for an exploration shaft on the Kanab North project in the Arizona Strip, Arizona;
6. Rio Algom purchased the Mi Vida mine in La Sal, Utah, and increased mill production to 750 tpd;
7. US DOE transferred all responsibility from Grand Junction, Colorado to Energy Information Administration, Washington, D.C.;
8. Kerr-McGee reorganized nuclear operations—New Mexico operation became Quivira Mining Co., and all other operations became Sequoyah Fuels Corp.

1984

US production fell to 15.6 million pounds. For the first time, the USA was no longer the largest-producing country in the world, as Canadian production reached 29.1 million pounds U_3O_8. The Nuexco Exchange Value at the beginning of the year was $20.25 and by December had fallen to $15.50, its lowest level since January 1975. Exploration drilling amounted to less than 2.5 million feet, the lowest total since 1952. The Arizona Strip again was the most active area, and a slight surge of interest arose when at least five major companies and eight small exploration companies and independents began competing for new exploration targets. Most other projects were curtailed or closed until favorable changes in the market occurred.

Project Start-up: Western Nuclear reopened Ruby Wells mine, 550 tpd, in Grants district, New Mexico;

Project Curtailments:
1. Quivira Mining Co., 40 percent of mines and mill, Grants district, New Mexico;
2. Union Carbide terminated all exploration in Grand Junction, Colorado.

Project Closures:
1. Atlas Corp., three mines and one mill in Moab, Utah;
2. Exxon, mine and mill in Highland, Wyoming;
3. Caithness Corp., McBryde solution mine in South Texas district, Texas;
4. Tenneco Minerals, West Cole solution mine in South Texas district, Texas;
5. Plateau Resources, mine in Ticaboo, Utah;
6. Western Nuclear closed mill in Wellpinit, Washington, after a five-month run;
7. Homestake, mill, Grants district, New Mexico;
8. Union Carbide closed two mills in Gas Hills, Wyoming and Uravan, Colorado after a four-month run;
9. Pathfinder Mines, underground mine, 2R South pit, Gas Hills, Wyoming.
Approximate production loss of 12,700 tpd.

Related Activities:
Union Carbide acquired control of White Mesa mill from Energy Fuels, which reserved 30 percent of capacity, Blanding, Utah;
2. Ranchers merged with Hecla Mining Co.;
3. Union Carbide's mineral resources will operate under subsidiary of UMETCO Minerals Corp.;
4. Energy Fuels applied for permits to develop the Canyon breccia pipe, Yavapai Co., Arizona;
5. Pathfinder Mines announced it will modernize Lucky Mc mill in Gas Hills, Wyoming.

1985

There now are fewer active US uranium exploration and development companies than at any time since 1950. Only five conventional mills were operating at mid-year, most at a reduced rate averaging 3,700 tpd in spite of an

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average design capacity of 9,450 tpd; most support mines are operating at the same rate. Nuexco's estimate for 1985 exploration drilling is 1.8 to 2.2 million feet; Nuexco's latest forecast of 1985 production is less than ten million pounds, 40 percent of which will be produced by solution and phosphate mining.

Project Start-ups:

1. Wyoming Fuel/ Ferret Exploration began construction on a 100-gallon-per-minute solution mining pilot plant at the Crow Butte project, Crawford, Nebraska, and projected annual start-up in the fourth quarter of 1985;
2. Chevron Resources resumed mining at Mt. Taylor in the Grants district, New Mexico for trial period of six to twelve months.

Project Closures:

1. Homestake, mines and mill after a four-month run in the Grants district, New Mexico;
2. Cotter Corp., mill, Cañon City, Colorado. (Plan to reopen in fourth quarter 1985.)

Related Activities:

1. Western Nuclear suspended all uranium operations and plans to sell all assets;
2. Gulf Minerals transferred base of operations from Denver, Colorado to San Francisco, California;
3. Amoco transferred all mineral projects to Cyprus Minerals.

Conclusion

The weak competitive position of US producers accounts for the barrage of mine closures and curtailments over the past five years. In the face of ever-strengthening foreign competition, attrition from the pool of US producers will continue. Absent any government intervention or sharp rise in market price, the US industry probably will continue to search for alternative methods for lower-cost production and richer orebodies. Though they are dwindling in number, those producers having lucrative long-term contracts may be able to survive through the end of the decade.

Many producers and observers believe that governmental intervention will be required, such as that proposed by the Uranium Producers of America (UPA). UPA is calling for changes in enrichment policy and restrictions on uranium imports, in addition to other measures, in order to revive the industry. Nevertheless, it is doubtful that efforts through political channels will be sufficient to revive the US production industry.

The following Appendix recounts the history of US uranium production and prices, dating back to the US AEC procurement of uranium for weapons programs. It also includes information on utility participation in uranium supply ventures.

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APPENDIX

Introduction

The history of the US uranium production industry is characterized by two distinct yet overlapping sources of demand: 1948 to 1970, and 1966 to the present. The US government initiated commercial uranium production in 1947 and, throughout that initial era, dictated the price of uranium through procurement policies implemented by the Atomic Energy Commission (AEC). Following a brief transitional phase, free market forces took over as the determinant of uranium prices, and today are the basis for the fluctuations in the market price. The early period witnessed the rapid expansion of the uranium mining industry in response to incentives offered by the governments of the USA and the United Kingdom for uranium destined for use in their respective weapons programs. As stockpiles grew, the demand for uranium declined rapidly and the uranium mining industry fell into a recession. In the second era, the gradual growth of demand for uranium as fuel for nuclear power plants stimulated a recovery of the mining industry. The expansions and contractions which characterized the second era resulted from the changing balance between the fundamental demand for uranium as reactor fuel versus the demand to fulfill enrichment contracts. The inflexibility of the fixed-commitment enrichment contracts led to a catastrophic buildup of inventories throughout the fuel cycle; that inventory overhang plagues the industry now and will depress market prices for years to come.

The early success of the AEC procurement program can be attributed in part to the large number of independent prospectors who made initial discoveries in many of the important uranium districts. By the mid-1950s, however, the prospector was displaced by newly organized mining companies and joint-venture partners combined with the effects of changing government purchasing practices. Major international mining companies later assumed the dominant role, only to be supplanted in recent years by foreign competition, oversupply, unfavorable economics, and continuing regulatory changes.

The AEC Program

Government agencies have influenced the US uranium industry to some degree since its inception. Two phases of the first era (1947 to 1970) were the direct result of U_3O_8 procurement and policy changes instigated by the AEC. In the early years of the AEC uranium procurement program, the primary objective was to obtain uranium for weapons programs, so the AEC set up eleven *buying stations* and paid price incentives for ore delivered to the stations. Minimum base prices for ores of various types and grades were guaranteed by the AEC, in addition to quantity and development allowances and initial production bonuses. Table 5 is a partial schedule of AEC pricing structure and incentives.

The discovery of the large, high-grade Mi Vida deposit in 1952 prompted a surge of activity, and provided incentive for major energy companies to enter the uranium industry. In the following years, important discoveries occurred in the Gas Hills and Shirley Basin of Wyoming, in Ambrosia Lake, New Mexico, and in the South Texas district. Seven privately owned processing mills were in operation by 1953. That year, ore sales to mills and the buying stations totaled almost 200,000 tons of uranium ore. Throughout this period in the industry's history, as shown in Table 6, the average price paid by the AEC for uranium ranged from $7.14 in 1948, to $12.35 in 1953 and $8.15 in 1961.

The number of operating mines increased steadily, reaching an all-time high of approximately 750 by mid-1956; twelve mills were operating at a capacity of over 9,200 tons of ore per day. However, by year-end, exploration and development activity began to decline as the result of an AEC announcement that a new uranium procurement program would begin April 1, 1962. The AEC buying price would be set at $8.00 per pound U_3O_8. The announcement had a devastating effect on the industry. Many independent producers and small companies abandoned the industry permanently. The larger, well-established mining companies were able to survive the AEC policy change, but the era of the independent producer had ended.

The new program extended the procurement policy through December 1966, and the industry responded to the new program by further curtailing exploration. Despite drilling decreases, some important new discoveries were made.

Because of successful exploration and development programs, ore reserves and milling capacity had increased significantly by 1957. The AEC's procurement policy had achieved its goals, and thus, the AEC announced in May 1958 that the government would buy only a limited quantity of concentrates mined from ore deposits developed prior to November 24, 1958. The reduction in exploration activity was immediate, declining from 9.2 million feet drilled in 1957 to 5.6 million feet drilled in 1960. The number of operating mines had decreased to 590 by the end of

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1960, but operating mines had increased to 26, the highest number to date.

Another major policy change occurred in 1958. The AEC announced in May that it would allow private sales of uranium concentrate to domestic and foreign buyers provided it was used for peaceful purposes. All sales would be subject to AEC license approval. This event had been anticipated for some time, but it was not implemented in a timely fashion. A number of producers became impatient waiting for the private market to develop, so they halted activity. A flurry of activity that producers may have expected following the announcement did not occur; the first sale of domestic material to a private entity was not made until 1966.

In 1962, faced with a growing stockpile, the AEC adopted the previously announced procurement program which lowered the established purchase price to $8.00 per pound U_3O_8 through 1966. However, the continued viability of the US producer industry was in question, so the AEC included a provision that extended the procurement program by three years, through 1970. The *stretch-out* program, whereby producers could voluntarily defer delivery of their 1963-1966 contract commitments until 1967 and 1968, applied to contracts with the AEC after 1966. In return the AEC agreed to purchase in 1969 and 1970 additional uranium equal to the amount deferred. Eleven of seventeen milling companies participated in the stretch-out program; meanwhile, the number of active mines fell below 400.

The passage in 1964 of the Private Ownership of Special Nuclear Materials Act (Public Law 88-489) officially ended the government's monopoly on the use of uranium. The Act was intended to encourage the private sector to participate in the commercial use of uranium for power generation. However, the decline in demand for uranium for nuclear weapons was not immediately offset by the growing use of uranium for electricity generation. Consequently, the AEC dropped its options to purchase non-US (mostly Canadian) uranium, and in 1966 the government placed an embargo on the enrichment of foreign uranium for use in domestic power plants. Stockpiling and forward buying of uranium in anticipation that the embargo would be lifted were not prohibited. This situation led to the formation of large stockpiles in the USA, Canada, and South Africa. The embargo offered some assurance that sufficient domestic capacity would be available to maintain a viable producer industry. The AEC estimated domestic requirements at 15.6 million pounds U_3O_8 in 1968, growing to 186.0 million pounds by 1975 (the estimate was downgraded in 1971 to 132.4 million pounds).

Large stockpiles, worldwide overproduction, and a

Table 5

PARTIAL SCHEDULE OF AEC PRICES FOR URANIUM ORE

Grade of Ore, Percent U_3O_8	Pounds of U_3O_8 per Ton of Ore	Base Price		Grade Premium		Price per Ton of Ore			
		Pound U_3O_8	Ton of Ore	75¢/lb. Over 4 lbs.	25¢/lb. Over 10 lbs.	Mine Development Allowance 50¢/lb.	Price Before Initial Production Bonus & Haulage Allowance	Initial Production Bonus on 10,000 lbs.	Price Before Haulage Allowance
0.10	2.00	$1.50	$3.00	—	—	$1.00	$4.00	$3.00	$7.00
0.15	3.00	2.50	7.50	—	—	1.50	9.00	7.50	16.50
0.20	4.00	3.50	14.00	—	—	2.00	16.00	14.00	30.00
0.25	5.00	3.50	17.50	0.75	—	2.50	20.75	17.50	38.25
0.30	6.00	3.50	21.00	1.50	—	3.00	25.50	21.00	46.50
0.35	7.00	3.50	24.50	2.25	—	3.50	30.25	24.50	54.75
0.40	8.00	3.50	28.00	3.00	—	4.00	35.00	28.00	63.00
0.45	9.00	3.50	31.50	3.75	—	4.50	39.75	31.50	71.25
0.50	10.00	3.50	35.00	4.50	—	5.00	44.50	35.00	79.50
1.00	20.00	3.50	70.00	12.00	2.50	10.50	94.50	70.00	164.50
5.00	100.00	3.50	350.00	72.00	22.50	50.00	494.50	350.00	844.50

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Table 6

AVERAGE PRICE PAID BY AEC FOR DOMESTIC URANIUM PURCHASES[1] (Fiscal years 1948-1971)

Fiscal Year	Average Price (US $ per pound U_3O_8)
1948	7.14
1949	8.53
1950	9.11
1951	10.10
1952	11.18
1953	12.35
1954	12.27
1955	12.25
1956	11.51
1957	10.49
1958	9.45
1959	9.12
1960	8.75
1961	8.50
1962	8.15
1963	7.82
1964	8.00
1965	8.00
1966	8.00
1967	8.00
1968	8.00
1969	6.99
1970	5.74
1971	5.54
Overall Average	$8.52

Source: "Statistical Data of the Uranium Industry" (US Department of Energy, Grand Junction, Colorado), GJO-100 (80), p. A-2.

[1]Purchases are shown for the year in which the concentrate was received in accordance with contract provisions. Uranium recorded as a by-product from the processing of phosphates, euxenites, etc., is not included.

reluctance by utilities to enter into long-term supply contracts characterized the market in the late 1960s. Therefore, the prices given in Table 6 do not represent a market equilibrium price as would have been determined by the unhindered interaction of supply and demand. During the 1950s, prices were deliberately maintained at a level which enabled the USA and UK to build up their nuclear weapons inventories and to establish their strategic stockpiles. Stockpiling, stretch-out programs, and the growth of demand from utilities combined with an embargo on uranium imports to shelter US producers from the possibility that competition might have determined a price uneconomic for them. During this period, non-US producers were selling uranium concentrates at prices considerably below those established by the AEC.

Industry response to the rash of AEC policy changes was to curtail exploration, development, and production throughout the early-to-mid 1960s. The level of exploration activity began to recover in 1966, coinciding with the enactment of the embargo. Drilling increased from 2.1 million feet in 1965 to a high of 29.9 million feet in 1969. Development of new mines increased in 1966 and production in 1967. Production gradually increased from 20 million pounds U_3O_8 in 1966 to more than 26 million pounds by 1970, when the AEC program ended. The AEC purchased over 348 million pounds of uranium concentrates during the span of its procurement program. While government jurisdiction over the industry has endured, virtually all subsequent uranium sales have occurred in the private sector.

Transition to a Commercial Market

The first sale of uranium to a private utility occurred in 1966. General Public Utilities signed a contract to supply its Oyster Creek Unit 1, and other sales followed as utilities embarked on nuclear power plant construction programs. Orders for uranium concentrates began appearing at prices below the $8.00 per pound level then being paid by the AEC. At the end of 1970, AEC purchases ceased when its stockpile amounted to approximately 50,000 short tons U_3O_8. Because of the considerable time lag between plant order and date of commercial operation (and also due to the fact that Westinghouse had agreed to supply buyers of its reactors with uranium at fixed prices over the plant's early years of operation), the demand for uranium was not expected to increase until the mid-1970s. Thus, from 1968 to 1972, prices continued to decline as a result of excessive supply, overproduction, and delays in the licensing and construction of nuclear plants.

The largest industrial buyers were the reactor manufacturers—Westinghouse Corp., General Electric Corp., Babcock & Wilcox Co., and Combusion Engineering Corp.—which often agreed to provide fabricated fuel for their utility customers, in the process agreeing to furnish all the necessary goods and services constituent to the fuel. Certain utilities chose to purchase their uranium supplies independently, and by late 1967 the volume of utility purchasing exceeded that of the fabricators. The uranium

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industry resumed extensive exploration and orebody development. By mid-1967, the number of major participants had increased to at least 50, of which 15 were oil companies with large exploration and development budgets. In addition, domestic and foreign utilities became active in exploration, usually as joint venture partners with the leading mining companies. The industry rapidly became more competitive. This surge of activity slowed considerably when the perceived potential for a shortage of uranium resources in the US caused plant orders to decline in early 1968. However, the momentum of exploration and development activity carried most programs into the early 1970s, as illustrated by the high drilling rate of 29.8 million feet in 1969.

Establishment of a Spot Market Price

In September 1968, Nuexco (then Nuclear Exchange Corporation) published its first report on the uranium market. In it, Nuexco attempted to describe by means of a price judgment the state of the spot or near-term market for uranium as of the publication deadline for each issue. The price, now known as the Nuexco Exchange Value, has undergone numerous changes, in definition and in the various factors that influence it, yet it remains the leading indicator of spot or near-term market uranium prices. The depressed prices of the 1968 to 1972 period are evident in Exchange Values for that period (see Historical Market Data in this Report).

The Early 1970s

Faced with continuing oversupply, low U_3O_8 prices, few reactor orders, and the termination of the AEC procurement program in December 1970, industry participants began to curtail or abandon projects. Seventeen mills were in operation at the end of 1972, and production amounted to 26 million pounds U_3O_8. Surface drilling dropped to 23.5 million feet in 1970 and 15.4 million feet in 1972. The AEC then estimated ore reserves less than $8.00 per pound to be 273,000 tons U_3O_8. For the first time, the AEC publicly discussed ore reserves based on cost categories of $10.00, $15.00, and $30.00 per pound.

Activity increased in the second half of 1973 as utilities made agreements for the delivery of approximately 45,000 tons U_3O_8 from 1974 to 1994. AEC records indicate that commercial sales to domestic utilities had increased by 90,600 tons U_3O_8 since 1970, and totaled 175,600 tons U_3O_8 for delivery during the 1974-1994 period. Sales to foreign utilities totaled 6,900 tons U_3O_8, of which 5,700 tons had been delivered by the end of 1973.*

Two events that had a profound effect on the uranium production industry occurred within a six-month period. First, in October 1973, OPEC (Organization of Petroleum Exporting Countries) introduced a worldwide oil embargo, which led to dramatically higher energy prices, including those of coal and natural gas. The embargo led many observers to fear a worldwide energy shortage, and forced utilities to reevaluate the nuclear energy option. Utilities reacted quickly, placing new orders for nuclear plants and attempting to secure uranium supply contracts of unprecedented length. They also became less concerned about price, and U_3O_8 prices began to rise as a result. The Nuexco Exchange Value increased from $6.50 to $6.75, the highest level recorded by Nuexco, one month after the embargo announcement. By the end of 1974, the Exchange Value had reached $15.00; exploration drilling had increased to 22.0 million feet and exploration expenditures totaled $80 million. The AEC estimated total ore reserves in all cost categories at 600,000 tons U_3O_8.

The second important event occurred in early 1974, when the AEC announced a change in its uranium enrichment policy. The Requirements-type contract, which allowed customers ample flexibility, was replaced with the Long-Term, Fixed-Commitment Contract. The new contract obligated utilities to furnish feed material for enrichment under long-term contracts without allowing for reductions in reactor requirements, thereby inducing them to incur long-term obligations for uranium supply. Utilities responded by quickly filling future U_3O_8 requirements with purchase contracts for delivery in the early 1980s and beyond. Utility purchases increased from 175,600 tons U_3O_8 in the beginning of 1974 to 289,200 tons at the end of 1977. In addition, US utilities entered purchase commitments with foreign producers totaling 39,200 tons U_3O_8, while US producers sold 6,600 tons to foreign utilities.

Several other events had similar effects on uranium prices and upon pricing mechanisms during this period:

1. The US government announced its decision to reduce its stockpile by operating its enrichment plants at higher tails assay than specified in its service contracts. This action (called the split-tails policy) relieved the downward pressure on the price of uranium that was caused by the existence of a stockpile of approximately 50,000 short tons U_3O_8.

*Statistical Data of the Uranium Industry (USAEC, January 1, 1974), GJO-100 (74), page 58.

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2. Westinghouse announced in 1975 that it would not honor its agreements to supply uranium at fixed prices, so utilities took action to satisfy requirements that they previously had considered covered.

3. An international cartel was formed to protect the non-US uranium producers. Its effect on price has been the focus of a great deal of study, but the results are still being debated.

The Nuexco Exchange Value rose sharply from 1974 to 1976; fixed-price contracts declined in importance and contracts containing provisions for market-related pricing became popular. Contract rigidities, however, served to moderate the post-1973 price surge. Producers forced the renegotiation of numerous contracts, but substantial quantities were still being delivered under older, lower-priced contracts. Relatively stable spot prices prevailed between 1976 and 1979; delivery prices continued to rise as new contracts were negotiated at higher prices. In 1976, the US Energy Research and Development Administration (ERDA), formerly the AEC, began publishing the annual average price of uranium deliveries to US buyers. The average price in 1975 was published in 1976. Table 7 lists 1975 through 1983 average prices published annually by DOE (formerly ERDA and AEC).

Table 7

ANNUAL AVERAGE PRICE OF URANIUM DELIVERIES TO US BUYERS[1]
(US $ per pound U_3O_8)

Year	Average Price
Pre-1975	not reported
1975	10.50
1976	16.10
1977	19.75
1978	21.60
1979	23.85
1980	28.15
1981	32.20
1982	38.37
1983[2]	38.21
1984[3]	—

Source: "Survey of United States Marketing Activity." (US Department of Energy: published annually.)

[1]Includes all prices for delivered uranium, including long-term contracts previously negotiated and excluding prices of uranium not yet delivered, even though the price may have already been determined.

[2]Unadjusted price. Includes settlements of market-price contracts.

[3]Scheduled for release October 5, 1985.

Utility Involvement in Uranium Production

During the price rise of the 1974 to 1977 period, utility participation in exploration programs increased dramatically. Utilities were concerned about securing reliable fuel supplies, so many became active in production ventures, either through associations with exploration and mining companies or by acquiring independent facilities. Table 8 gives brief references to some of the ventures undertaken by utilities for uranium supply.

The utility participation in mining ventures further stimulated industry activity in this period, largely because of the additional financial support. ERDA records indicate that surface drilling increased to 34.2 million feet in 1976, with 16 mills operating at a capacity of 31,160 tons of ore per day. Two solution mines operated in 1976, adding approximately 1.2 million pounds U_3O_8 to the total production figure of 28 million pounds U_3O_8. However, only a few of the largest utilities achieved long-term success in their mining ventures of the mid-1970s and are still active today; many utilities abandoned projects in the late 1970s and early 1980s.

The Late 1970s

The effects of inflation forced ERDA to continue to make adjustments to in-place uranium resource estimates based on various cost categories. In doing so, the inflationary effects were reduced, but the actual resource base remained questionable. ERDA began to quantify resources based on the reduction of in-place ore grades, the inclusion of low-grade deposits, and the adoption of higher production costs. The AEC introduced the $10.00 cost category in 1971, the $15.00 category in 1972, the $30.00 category in 1973, the $50.00 category in 1977, and the $100.00 category in 1980. In addition, the $8.00 category established in 1947 was reclassified as the $15.00 category at the end of 1976.

Delays in nuclear power plant completion schedules, plant cancellations, and the lack of new plant orders began to affect the utilities by the end of 1975. The production industry, however, continued operating with apparent indifference to the changing attitudes of the utilities. Surface drilling increased to 40.5 million feet in 1977 and 47.0 million feet in 1978, the highest annual drilling rate ever. Over 100 production companies were active in this period, and 20 mills operated at a capacity of 43,810 tons of ore per day. Seven solution mines were in operation in the South Texas district and one in the Powder River Basin, Wyoming. In addition, projects to recover uranium from phosphoric acid were in operation at three Florida loca-

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Table 8

US ELECTRIC UTILITIES' PAST INVOLVEMENT IN URANIUM SUPPLY
(Partial summary compiled from published documents)

Arizona Public Service Company	Exploration in Date Creek, Arizona and Green Mountain, Wyoming areas. Bought Christensen Ranch property.
Baltimore Gas & Electric Company	With International Energy Corp. in Texas, and through an exploration joint venture in southern Wyoming with Philadelphia Electric Co., Pennsylvania Power & Light Co., and Public Service Electric & Gas Co.
Commonwealth Edison Company	Through its subsidiary companies: Cotter Corporation has a mine and mill operation and a crushing and sampling plant in Colorado. Nuclear Resources, Inc. was providing 90 percent of the funds for the Cleveland Cliffs Iron Co. and Getty Oil Co. exploration venture in the Powder River Basin, Wyoming. Commonwealth Edison also formed a joint venture with Wold Nuclear Company in the Red Desert, Wyoming area.
Consumers Power Company	Exploration and ore buying through its subsidiary, Plateau Resources, in Colorado and Utah. Mill in Shootaring Canyon in southeastern Utah. Plateau Resources also operated an exploration venture in southeastern Utah with Nuclear Dynamics and Frontier Resources.
Duke Power Company	Through its subsidary Western Fuel Inc. in unspecified areas.
Florida Power & Light Company	Exploration through a subsidiary, Fuel Supply Service, Inc., in joint venture with Getty Oil Co. in Colorado, Wyoming, and New Mexico.
Gulf States Utilities Company	Through a subsidiary, Varibus Corp., with Felmont Oil in Wyoming.
Houston Lighting & Power Company	Exploration in Wyoming through a subsidiary, Utility Fuels, Inc. Mining joint venture in Shirley Basin, Wyoming.
Kansas Gas & Electric Company *and* Kansas City Power & Light	Jointly formed Utilities Fuels Co., which had a mining venture with Cobb Nuclear in New Mexico.
Long Island Lighting Company	With Bokum Resources Corp. in New Mexico.
Niagara Mohawk Power Corporation	50 percent of a solution mining venture with U.S. Steel near Clay West, Texas.
Pacific Gas & Electric Company	Financing of a Texas solution mining project operated by Intercontinental Energy Co.
Pennsylvania Power & Light Company	Through its subsidiary URADCO. Joint venture with three other utilities in Wyoming.
Philadelphia Electric Company	Joint exploration venture in Wyoming with three other eastern utilities.
Portland General Electric Company	Prospecting in Wyoming, California, and Alaska. Development drilling in California.
Public Service Electric & Gas (New Jersey)	Through a joint venture with three other electric utilities. The utility had an arrangement to provide some of the advance financing to Kerr-McGee Corp. for a mining and milling operation in Wyoming. PSEG also had a joint exploration venture in Wyoming with Homestake Mining Co.
Southern California Edison Company	Joint venture partner in uranium exploration, mining, and milling activities of Rocky Mountain Energy, e.g., the Bear Creek mine and mill complex, north of Douglas, Wyoming. Another Wyoming mine and mill complex (Copper Mountain) which was planned to start up in 1982 or 1983 has been deferred indefinitely.
Texas Utilities Company	Through its subsidiary, Texas Utilities Fuel Co., had a joint exploration and development venture with Ranchers Exploration and Development Corporation in Colorado, Utah, Wyoming, and New Mexico.

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tions and from four heap leach operations in Colorado, Texas, and Utah. Production totaled 40.4 million pounds U_3O_8 in 1978, and in mid-1978 the Nuexco Exchange Value peaked at $43.40 per pound U_3O_8.

The uranium production industry's reactions to changes in the market were negligible in 1979. Exploration drilling declined slightly to 40.7 million feet, but 21 conventional mills operated at a capacity of 49,050 tons of ore per day, and total production reached 41.4 million pounds U_3O_8 in 1979. The Nuexco Exchange Value declined from $43.25 per pound U_3O_8 to $40.75 by the end of the year, the beginning of a decline that was to continue, except for brief interruptions, until the present.

Production in 1980 reached an all-time high of 46.6 million pounds U_3O_8 from 23 conventional mills, 11 solution mines, six phosphoric acid projects, and three heap leach operations. Nevertheless, rapidly declining uranium prices and utility announcements of further plant cancellations and delays triggered visible changes in the production industry. Exploration companies began to postpone and cancel projects, and exploration drilling fell to 27.8 million feet, 32 percent below the 1979 figure. The Nuexco Exchange Value fell to $27.00 by the end of the year. Many companies lacking high-priced delivery contracts were forced to abandon the uranium industry, and the exodus of 1981-1985 had begun.

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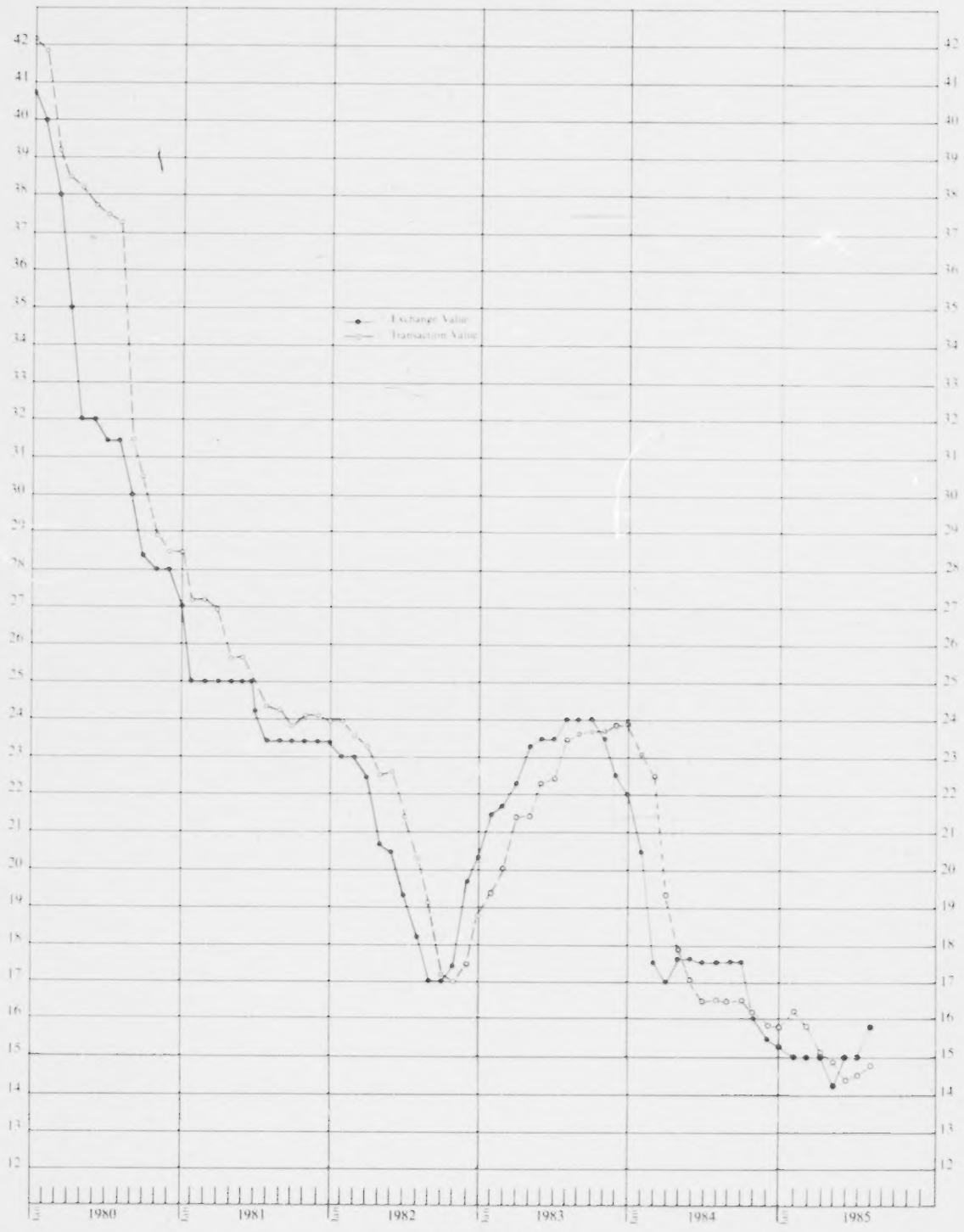
HISTORICAL MARKET DATA

EXCHANGE AND TRANSACTION VALUES SINCE JANUARY 1980

Determined as of the last day of the month indicated



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HISTORICAL EXCHANGE VALUES

Determined as of the last day of the month indicated (US Dollars lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1968	—	—	—	—	—	—	—	6.35	6.35	6.40	6.45	6.50
1969	—	6.35	6.10	6.10	6.25	6.25	6.20	6.20	6.15	6.15	6.15	6.20
1970	6.30	6.30	6.30	6.30	6.30	6.30	6.30	6.20	6.15	6.15	6.15	6.15
1971	6.20	6.20	6.20	6.20	6.15	6.05	6.00	5.95	5.95	5.95	5.95	5.95
1972	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95	5.95
1973	5.95	6.00	6.10	6.20	6.45	6.50	6.50	6.50	6.50	6.50	6.75	7.00
1974	7.70	7.90	8.00	9.00	9.50	10.50	11.50	12.00	12.50	14.00	14.75	15.00
1975	16.00	16.00	18.00	20.00	21.00	23.00	24.70	26.00	26.00	28.50	30.00	35.00
1976	32.50	37.00	39.25	40.00	40.00	40.00	40.00	40.40	41.00	41.00	41.50	41.00
1977	41.35	41.50	41.60	41.60	42.00	42.25	42.25	42.25	42.40	42.75	43.20	43.20
1978	42.90	43.25	43.25	43.25	43.40	43.40	43.40	43.10	43.25	43.00	43.25	43.25
1979	43.25	43.25	43.25	43.25	43.25	43.00	42.70	42.70	42.20	42.20	41.00	40.75
1980	40.00	38.00	35.00	32.00	32.00	31.50	31.50	30.00	28.50	28.00	28.00	27.00
1981	25.00	25.00	25.00	25.00	25.00	24.25	23.50	23.50	23.50	23.50	23.50	23.50
1982	23.00	23.00	22.50	20.75	20.50	19.25	18.25	17.00	17.00	17.50	19.75	20.25
1983	21.50	21.75	22.25	23.25	23.50	23.50	24.00	24.00	24.00	23.50	22.50	22.00
1984	20.50	17.50	17.00	17.75	17.75	17.50	17.50	17.50	17.50	16.00	15.50	15.25
1985	15.00	15.00	15.00	14.25	15.00	15.00	**15.75**					

HISTORICAL TRANSACTION VALUES

Determined as of the last day of the month indicated (US Dollars lb. U_3O_8)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1976	—	—	—	—	39.60	39.70	39.70	40.40	40.30	40.60	40.70	40.70
1977	41.30	41.30	41.40	41.50	42.80	42.90	43.00	42.60	42.50	42.80	42.90	42.90
1978	43.10	43.30	43.70	43.60	43.60	43.20	43.30	43.40	43.40	43.60	43.40	42.70
1979	43.60	43.80	43.70	43.40	43.60	43.70	43.70	43.60	43.60	43.60	43.50	42.30
1980	42.00	39.30	38.60	38.40	37.90	37.60	37.30	31.60	30.60	29.00	28.70	27.70
1981	27.20	27.20	27.00	25.70	25.70	24.50	24.40	24.30	23.90	24.10	24.10	24.00
1982	24.00	23.70	23.40	22.60	22.70	21.50	20.30	19.10	17.30	17.00	17.55	18.80
1983	19.35	20.00	21.35	21.40	22.35	22.45	23.50	23.60	23.65	23.65	23.85	23.85
1984	23.05	22.50	19.25	17.90	17.00	16.50	16.60	16.40	16.55	16.05	15.90	15.90
1985	16.20	15.70	15.05	14.90	14.45	14.60	**14.75**					

HISTORICAL CONVERSION VALUES

Determined as of the last day of the month indicated (US Dollars lb. U as UF_6)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
1981	1.20	1.20	1.20	1.40	1.15	1.15	1.15	1.10	1.10	1.10	1.20	1.20
1982	1.20	1.20	1.20	1.20	1.00	1.00	1.00	0.90	1.10	1.60	1.45	1.45
1983	1.20	1.40	1.40	1.20	1.20	1.20	1.10	1.10	1.00	0.60	0.60	0.60
1984	0.60	0.30	0.80	0.80	0.80	0.00	0.00	0.80	1.00	1.00	0.80	0.80
1985	1.00	1.00	1.00	1.50	1.50	1.60	**1.60**					

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GOVERNMENT STATISTICS

AUSTRALIA

	Price Index of Materials Used in Manufacturing Industry—All Groups[1] (1969=100)	Award Rates of Pay Indexes Australia—Adult Males In Mining Wage and Salary Earners, Weekly Rates[2] (1976=100)
1983 Avg.	401.2	181.8
Jun 1984	404.7R	197.4
Jul 1984	408.3R	197.4
Aug 1984	413.1R	197.4
Sep 1984	411.9R	197.4
Oct 1984	408.4R	197.4
Nov 1984	407.1R	197.4
Dec 1984	405.9R	197.4
Jan 1985	409.3R	197.4
Feb 1985	416.0	197.4
Mar 1985	426.8R	197.4
Apr 1985	436.6	202.3
May 1985	—	202.3
Jun 1985	—	202.4

P = Preliminary R = Revised since last month

CANADA

	Industry Selling Price Index: Manufacturing[1] (1971=100)	Wage-earner Data: Average Hourly Earnings (C$)[2] Uranium Mines (SIC 057)	Metal Mines* (SIC 051-059)	Mines, Quarries and Oil Wells[3] (SIC 051-099)	Primary Metal Industries Non-ferrous[4] (SIC 296)	(SIC 298)	Chemicals and Chemical Products[5] (SIC 372-379)
1983 Avg.	298.8	—	—**	14.30	—	—	11.17
Aug 1984	312.7	17.24	15.36	14.92	12.44	10.34	11.78
Sep 1984	312.3	17.68	15.96	15.34	12.51	10.52	11.90
Oct 1984	312.3	17.64	16.15	15.26	12.69	10.56	11.96
Nov 1984	313.6	18.04	16.13	15.43	12.47	10.51	11.96
Dec 1984	314.2	17.95	16.39	15.60	12.16	10.40	11.99
Jan 1985	315.8	18.05	16.13	15.60	12.32	10.80	12.04
Feb 1985	316.4	18.78	16.41	15.68	12.54R	11.05	12.06
Mar 1985	317.9R	18.24	16.21	15.57R	12.43	10.97	12.02
Apr 1985	318.1	18.63	16.44R	15.80R	12.81R	11.23R	12.04R
May 1985	318.7	18.56P	16.44P	15.67P	12.86P	11.21P	12.15P
Jun 1985	318.9	—	—	—	—	—	—

P = Preliminary R = Revised since last month

For annual averages prior to 1983, and for notes pertaining to these statistics, see pages 23-26 of Report 190 of June 1984.

* The 1980 average for Metal Mines was incorrectly reported as 10.59. The correct average is 10.58 (see Report 190).

** Two different methods were used in the 1983 "Metal Mines" category in reporting survey data, and Statistics Canada did not publish a 1983 average. The March 1983 figure for the old method was 14.73 and for the new method was 14.84. The published average for 1983 in Report 190 was a Nuexco calculation based on the available monthly statistics for 1983 with the exception of the March figure, where only the 14.84 value was taken into account.

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GOVERNMENT STATISTICS

REPUBLIC OF SOUTH AFRICA

	Average Declared Working Costs per per Metric Ton of Gold Ore Milled (Rand)[1]	Tonnage-Weighted Index of Average Working Costs per Metric Ton of Gold Ore Milled (March 1982=100)[2]	Consumer Price Index[3] (1975=100)[4]	Producer Price Index All Groups[5] (1975=100)	Total Employment in Mining and Quarrying (Code 35)[6]	Total Salaries and Wages in Mining and Quarrying (1,000 Rand) (Code 40)[6]
1983 Avg.	51.87	115.0	262.2	274.8	696,579	3,644,772
May 1984	—	—	288.3	292.6	710,040	327,937
Jun 1984	56.95	126.2	291.2	295.3	717,009	347,121
Jul 1984	—	—	295.1	296.0	717,121	369,964
Aug 1984	—	—	297.0	300.8	721,905	361,357
Sep 1984	60.64	133.2	299.9	304.1	721,470	359,218
Oct 1984	—	—	303.7	308.7	717,865	363,755
Nov 1984	—	—	307.4	312.8	717,396	369,771
Dec 1984	62.92	138.6	309.4	315.9	701,198	365,234
Jan 1985	—	—	177.1*	166.6*	711,366	376,777
Feb 1985	—	—	182.8*	171.3*	727,932	361,823
Mar 1985	64.48	142.4	183.6*	173.0*	708,809	371,380
Apr 1985	—	—	187.4*	174.0*	724,187	369,005
May 1985	—	—	189.5*	177.7*	—	—
Jun 1985	—	—	191.9*	—	—	—

*The basis for calculation for these indices has been revised to January 1980 = 100.

UNITED STATES

	Producer Price Index[1]		Consumer Price Index[2]	GNP Implicit Price Deflator[3]	Gross Average Hourly Earnings of Production or Non-supervisory Workers (US$)[4]			
	Industrial Commodities (1967=100)	All Commodities (1967=100)	(1967=100)	(1972=100)	Metal Mining (SIC 10)	Primary Non-ferrous Metals (SIC 333)	Chemicals and Allied Products (SIC 28)	Electric and Electronic Equipment (SIC 36)
1983 Avg.	315.8	303.1	298.4	215.63	12.57	13.43	10.59	8.65
May 1984	323.3	311.7	309.7	—	12.99	13.37	11.02	8.89
Jun 1984	323.9	311.4	310.7	222.40	12.96	13.40	11.03	8.91
Jul 1984	324.0	312.0	311.7	—	13.02	13.36	11.12	8.95
Aug 1984	323.5	310.9	313.0	—	13.10	13.51	11.13	9.00
Sep 1984	322.3	309.5	314.5	224.57	13.20	13.39	11.23	9.08
Oct 1984	323.2	309.4	315.3	—	13.23	13.53	11.32	9.09
Nov 1984	323.8	310.4	315.3	—	13.23	13.76	11.35	9.15
Dec 1984	323.0	309.9	315.5	226.10	13.28	13.66	11.37	9.27
Jan 1985	322.9	309.5	316.1	—	13.29	13.70	11.39	9.33
Feb 1985	322.5	309.2	317.4	—	13.30	13.73	11.39	9.33
Mar 1985	322.6	308.7	318.8	229.07R	13.29	13.95	11.37	9.39
Apr 1985	323.8	309.3	*320.1*	—	*13.43R*	*13.62R*	11.48R	9.40R
May 1985	325.3	309.9	321.3	—	13.24P	13.58P	11.46P	9.41P
Jun 1985	325.2	309.5	322.3	230.65	—	—	11.51P	9.47P

P = Preliminary R = Revised since last month

For annual averages prior to 1983, and for notes pertaining to these statistics, see pages 23-26 of Report 190 of June 1984.

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